(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 May 2004 (21.05.2004)

PCT

(10) International Publication Number
WO 2004/042831 A2

(51) International Patent Classification[7]: H01L 33/00

(21) International Application Number:
PCT/IB2003/004881

(22) International Filing Date: 31 October 2003 (31.10.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
02079677.7 7 November 2002 (07.11.2002) EP

(71) Applicant *(for all designated States except US)*: KONINKLIJKE PHILIPS ELECTRONICS N.V. [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: WOERLEE, Pierre, H. [NL/NL]; c/o Prof . Holstlaan 6, NL-5656 AA Eindhoven (NL). 'T HOOFT, Gert, W. [NL/NL]; c/o Prof . Holstlaan 6, NL-5656 AA Eindhoven (NL). HOLLEMAN, Jisk [NL/NL]; c/o Prof . Holstlaan 6, NL-5656 AA Eindhoven (NL).

(74) Agent: DUIJVESTIJN, Adrianus, J.; Philips Intellectual Property & Standards, Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

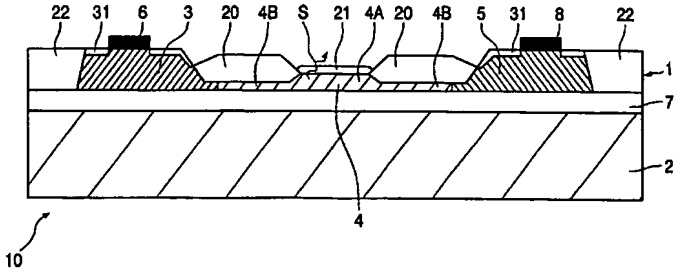
(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: RADIATION-EMITTING SEMICONDUCTOR DEVICE AND METHOD OF MANUFACTURING SUCH A DEVICE



(57) Abstract: Radiation-emitting semiconductor device and method of manufacturing such a device. The invention relates to a radiation-emitting semiconductor device (10) comprising a silicon-containing semiconductor body (1) and a substrate (2), which semiconductor body (1) comprises a lateral semiconductor diode positioned on an insulating layer (7) which separates the diode from the substrate (2). The lateral semiconductor diode comprises a first semiconductor region (3) of a first conductivity type and with a first doping concentration, a second semiconductor region (4) of the first or a second conductivity type opposite to the first conductivity type and with a second doping concentration which is lower than the first doping concentration, and a third semiconductor region (5) of the second conductivity type and with a third doping concentration which is higher than the second doping concentration, the first and the third region (3, 5) each being provided with a connection region (6, 8), and, during operation, radiation (S) being generated in the second region (4) due to recombination of charge carriers injected therein from the first and the third region (3, 5). According to the invention, the second semiconductor region (4) comprises a central part (4A) which is surrounded by a further part (4B) the bandgap of which is larger than the bandgap of the central part (4A). In this way, the radiation yield is increased in an indirect semiconductor material such as silicon in the central part (4A) as translation of the relatively long-living charge carriers towards a non-radiative recombination center is limited because of the barriers in the valence and conduction band in the further part (4B). Preferably, the bandgap in the further part (4B) is made larger in that the thickness of said part (4B) is so small that quantum size effects occur therein, while the central part (4A) has a thickness which is so large that such effects do not occur or substantially do not occur.

WO 2004/042831 A2